THE ELECTRICAL WORLD

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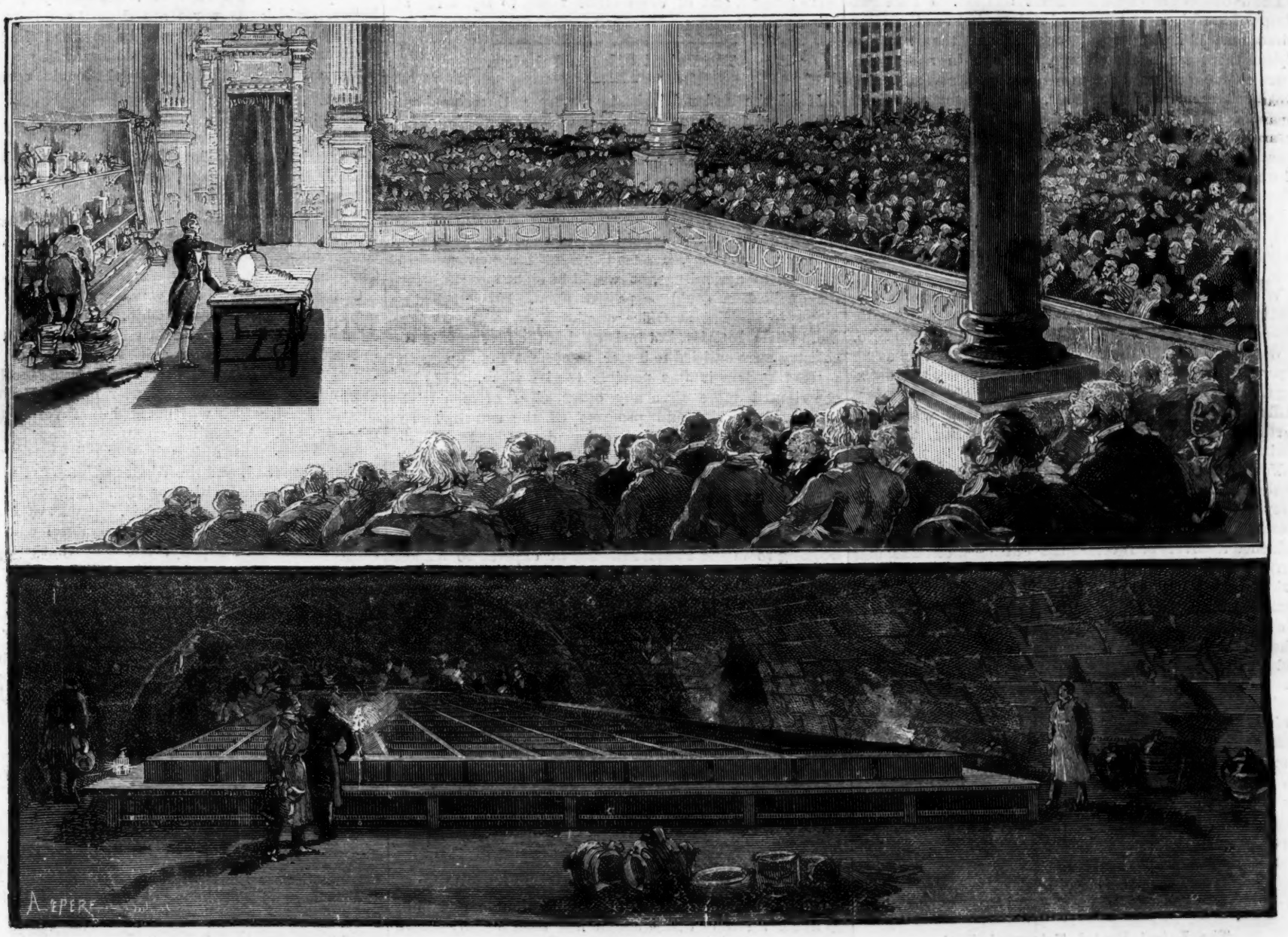
The First Exhibition of the Electric Light.

There are some discoveries and inventions so old that in order to trace their history to its beginning one must, like the celebrated burgomaster in Offenbach's opera bouffe, go back to the year "one—" Of such is not the electric light, whose production has scarcely yet ceased to be matter for public sensation and wonderment, and whose discovery dates no earlier than the first decade of the present century.

We give on this page an illustration of no small historic interest. It represents the first exhibition of the electric light by Sir Humphry Davy, at the Royal Institution in London, in 1810, and we reproduce it from *La Lumière Electrique*. The date is so recent as to belong to our own times. The story of the display may be briefly told. As our readers know, Volta announced in 1800 the invention and construction of his pile, the first source of dynamic electricity. A year later Davy, only twenty-one or twenty-two years of age, was appointed assistant lecturer at the Royal Institution, and, entering upon his duties with zeal and ardor, he was not slow to avail himself of the means for investigation and experiment placed at his disposal there in the voltaic pile. He made good use of the earlier batteries provided, but in 1808 found himself in possession of a battery of Brobdingnagian proportions, purchased by the subscriptions of a few generous patrons of science. It consisted of 2,000 cells, arranged in 200 porcelain troughs in a vault, after the manner indicated in the lower portion of our illustration. The plates were square, 32 inches in surface, and of zinc and copper. The fluid in which the plates were immersed was a mixture of sixty parts of water with one part of nitric acid and one of sulphuric acid. Davy had discovered and shown the carbon light on a very small scale in 1802, having learned how to obtain an "arc" by holding together two pieces of charcoal that were connected to the opposite poles of a battery and then drawing them apart; and he could now repeat his experiment on a grand scale and with startling brilliancy before the members of the Institution. It is well to give his own description of the display: "When pieces of charcoal about an inch long and one-sixth of an inch in diameter were brought near each other (within the thirtieth or fortieth part of an inch) a bright spark was produced, and more than half the volume of the charcoal became ignited to whiteness; and, by withdrawing the points from each other a constant discharge took place through the heated air in a space equal to at least four inches, producing a most brilliant ascending arc of light, broad and conical in form in the middle." The length of this arc was increased in vacuo to seven inches. The delight and surprise of the spectators was evidently very great.

One of the troughs used by Davy in the big battery is still preserved as a relic at the Royal Institution. It bears much the same relation to the electric lighting apparatus of to-day that the fossil remains of a megatherium do to the modern racehorse, but it is a valuable memento, and one that is not to be despised. With his cumbrous apparatus and his poor pencils of common charcoal Sir Humphry Davy showed that it could be done, and the arc two feet in length, due to a current from the newest dynamo, is the natural result of the work of Volta and Davy. It is true that Davy's experiment did not fructify for nearly forty years, but there are probably laboratory experiments with which we have been familiar for a lifetime in which lie the germs of practical applications as great as the electric light.



DAVY'S EXHIBITION OF THE ELECTRIC LIGHT AT THE ROYAL INSTITUTION, LONDON, 1810.

The Theory of Magnetism.*

BY PROF. D. E. HUGHES, F.R.S.

(CONTINUED.)

Neutrality.

If I take this bar of soft iron, introduce it in the coil, and pass a strong electric current through the coil, you notice that it is intensely magnetic, holding up this large armature of iron and strongly deflecting the observing needle. I now interrupt the current; the armature falls, and the needle only shows traces of the previous intense magnetization.

What has become of this polarity? Or what has caused this sudden neutrality? Coulomb supposes that the magnetic fluids have become mixed in each molecule, thus neutralizing each other. Ampère supposes that the elementary currents surrounding each molecule have become heterogeneous. De La Rive, Wiedermann, Weber, Maxwell, and all up to the present time have accounted for this disappearance as a case of mixture of polarities, or heterogeneous arrangement.

My researches proved to me that neutrality has a symmetrical arrangement. I stated this in my paper upon the "Theory of Magnetism" to the Royal Society last year. I have since made a long series of researches upon this question, and my paper upon the subject will shortly be read at the Royal Society. This paper will demonstrate beyond question (1st) That a bar of iron under the influence of a current or other magnetizing force is more strongly polarized on the outside than in the interior; that its degree of penetration follows the well-defined law of inverse squares up to the saturation point of each successive layer. (2d) The instant that the current ceases a re-

* Paper read before the Royal Institution, 29th February, 1884.

action takes place, the stronger outside reacting upon the weaker inside, completely reversing it, until its reversed polarity exactly balances the external layers.

We might here suppose that there existed two distinct polarities at the same end of a neutral bar; but this is only partially true, as the rotation of the molecules from the inside to the exterior is a gradual well-defined curve, perfectly marked.

We see from this that in a large solid bar the reversed polarity would be in the interior, but in a thin bar under an intense field the reversed polarity would be on the outside. Thus, a bar which had previously strong north polarity under a strong external influence, would, the instant it formed its neutrality, have a strong north polarity in the interior, covered or rendered neutral by an equal strong south exterior, the sum of both giving the apparent neutrality that we notice.

I must refer all interested upon this question to my paper shortly to be read; but I will make a few experiments to demonstrate this important fact.

If I take this piece of soft steel and magnetize it strongly it has a strong remaining magnetism, or only partial neutrality. If I now heat this steel to redness, or put it into a state of mechanical vibration, the remaining magnetism almost entirely disappears, and we have apparent neutrality. This piece of steel being thin, ½ millimetre, I know that the outside is reversed to its previous state. I place this piece of steel in a glass vase near the observing needle, and at present there seems no polarity. Now pour dilute nitric acid upon it, filling up the vase. The exterior is now being dissolved, and in a few minutes you will see a strong polarity in the steel, as the exterior reversed polarity is dissolved in the acid. (Experiment shown).

Let us observe this by a different method. I take two strips of hard iron and magnetize them both in the same direction. If I place them together and then separate them, there seems no change, although in reality the mere contact produced a commencement of reversal. Let us vibrate them while together, allowing the molecules greater freedom to act as they feel inclined; and now, on separating, we see that one strip has exactly the opposite polarity to the other, both extremely strong, but the sum of which, when placed together, is zero, or neutrality. (Experiment shown).

Let us take two extremely soft strips, placed together, and magnetized while together; on withdrawal of the inducing force the rods are quite neutral. (Experiment shown).

We now separate these strips, and find that one is violently polarized in one direction, while the other is equally strong in the reversed, the sum of both being again zero.

We might suppose that the reaction is due to having separate bars. I will now demonstrate this by magnetizing this large ¾-inch bar with a magnetizing force just sufficient to render the rod completely neutral when held vertically or under the earth's magnetic influence. (Experiment shown).

You notice that it is absolutely neutral, all parts, as well as the ends, showing not the slightest trace of polarization. I reverse this bar, and you perceive that it is now intensely polarized. This is due to the fact that the earth's influence uncovers or reverses the outside molecules, and consequently they are now of the same polarity as its interior. Upon again reversing this rod the magnetism again disappears, and reappears if turned as previously. We have thus a rod which appears intensely magnetic when one of its ends is lowermost, while, if that same end is turned upward, all traces of magnetism will disappear. These and several other demonstrations which I shall now show you (proving the enormous influence which thickness of a bar has in the production of neutrality or its retention of magnetism) are simple lecture demonstrations. For the complete proof of my discovery of neutral curves I must refer you to my forthcoming paper upon this subject to be read next Thursday at the Royal Society. (Experiments shown proving the great influence of a thickness of a bar upon its retentive and neutral powers).

[TO BE CONTINUED.]

The Latest Postal Telegraph Bill.

The session of Congress is rapidly passing away, but nothing has yet been accomplished in the shape of actual legislation on postal telegraphy. Schemes and draft bills are plentiful, however. The postal telegraph bill, which received the approval of a majority of the Senate Committee on Post Offices and Post Roads a week ago, was retained in the committee until April 8th for the perfection of some of its details, and was reported by Senator Hill to the Senate on the 9th. The provision relating to the liability of the contracting company for failure correctly and promptly to transmit messages has been amended by limiting such liability to 500 times the amount paid for transmission. Two new features have been added to the bill. The first authorizes the contracting company to employ the Postmaster as its agent and operator at any postal telegraph office where the telegraphic receipts are insufficient to pay the salary of the operator and to pay him a commission not exceeding 50 per cent. on the charges on the messages transmitted from the office. The second requires the Postmaster-General to secure provisions in the contract which shall protect postal telegrams against discrimination in the order of transmission in favor of telegrams received at such of the company's offices as are not operated under the provisions of the bill. The contract system remains the most prominent feature of the bill, and is not widely different from the scheme of the Postal Telegraph Company except that it empowers the Postmaster-General to receive bids from any telegraph company for the contract. The provisions relating to the establishment of a Government system pure and simple in the event that no satisfactory contract with established companies is secured are a combination of the features of the Hill and Edmunds bill.

On the other hand, by a decisive majority the Committee on Post Offices and Post Roads of the House of Representatives has decided not to report favorably any bill authorizing the Government to construct a postal telegraph or to purchase any existing telegraph lines. This action practically kills all the measures before the committee for the establishment of a Government postal telegraph system except one. This is the bill prepared at the instance of the Postal Telegraph and Cable Company, which directs the Postmaster-General to enter into a contract with that company for the transmission of postal telegrams. Its provisions have already been published. It was understood, when the committee voted, that if the opponents of the proposition to have the Government build and operate its own lines were in a majority, the committee should take up the contract bill, with a view to recommending its adoption to the House, and, unless several committeemen change their views, such a report will be made, although the measure may be amended in some of its details. Ten of the sixteen members of the committee were present, and of these eight voted to lay aside all other postal telegraph bills than that above mentioned.

The Patent Office and System.

If all the national legislators were as thoughtful and far-sighted as Senator Platt, of Connecticut, the inventors in this country would not have much cause for alarm. On the 31st of March that gentleman made a remarkably good speech in the Senate in calling up for the purpose of making some remarks on it his bill providing for the organization of the Patent Office into a separate department. To illustrate the overcrowded condition of the business at present he said that, if a man invented a new machine relating to agriculture, it would be eight months before his application could be passed upon. He attached no blame to the Patent Office employes or to the Department of the Interior, but insisted that the inventors of the country were entitled to better treatment than under the present system it was possible to give them. They had contributed more than any other class of men to the wealth, prosperity and progress of the country. The Patent Office was the only department of the government that absolutely paid its own way, and, instead of continuing the practice of small appropriations, cramped quarters and a defective system that threw discouragements in the way, there should be large and liberal appropriations, ample working room and a sufficient staff of experts to dispose promptly and judiciously of all applications that may be sent in. In one passage he said: "We protect all our personal property by patents, we lock it up with patented locks, and if anybody breaks through and steals our treasures we overtake the thief by a patented telegraph. We defend our national honor by patents. We heard only yesterday that an unfortunate riot occurred in one of our principal cities. It was the telegraph which summoned the troops of the State to Cincinnati; it was that subtle force, so intangible, impalpable, invisible that we scarcely know whether it is material or spiritual which the inventive genius of man has harnessed to do his business, which at an instant's time summoned soldiers from all sections of Ohio to the defense of Cincinnati."

The Bankers and Merchants' Company's Service.

The rate at which a good telegraphic plant can be built up under vigorous management has been vividly shown in the operations of the Bankers and Merchants' Company, the third annual meeting of which was held in this city on April 5. President A. W. Dimock made his annual report, which described the affairs of the company as being in a very progressive condition. It was stated that during the past eight months the company had extended its system from 295 miles of poles and 1,995 miles of wire to 6,697 miles of pole and 46,347 miles of wire. Additional extensions are under contract which will give the company control of 10,000 miles of poles and about 100,000 miles of wire. The lines now cover the territory from the Atlantic to the Missouri River, and from the St. Lawrence River almost to the Gulf of Mexico. The following directors were re-elected: A. W. Dimock, J. R. Hegeman, George Putnam Smith, John B. Yale, G. S. Mott, John G. Case, W. W. Maris, J. P. McKewan and S. D. Houston. Subsequently Mr. Dimock was re-elected President; Mr. Hegeman, Vice-President; Mr. J. G. Case, Treasurer; and Mr. G. S. Mott, General Manager. Mr. Case has hitherto performed the duties of Secretary and Treasurer, but the office has now been divided, and Mr. J. B. Yale was elected Secretary.

Conflicting Telegraph and Telephone Interests.

It may not be generally known, but it is a fact, says the Pittsburgh *Commercial Gazette*, that the Bell Telephone Company offered the Western Union Company $10,000 to take out the Grey duplex instruments they have in this city operating the lines between here and the West. By this system constant use of the wire may be made from both ends at the same time, and yet communication between intermediate offices go on without trouble or interruption, even if Pittsburgh and Indianapolis, for instance, were both using the same wire at the time a local office was using it. The induction from the electric light wires, many of which run within twenty-two inches of the fire-alarm wires, is wonderful. The whirr of the machinery can be distinctly heard all night by placing the receiver of the telephone in the fire-alarm office to the ear. The Grey duplex wires run close to the Central telephone wires, and the battery in it is so strong that the thumping of the instruments can be clearly heard through the induction on the telephone wires, and caused so many complaints from subscribers that the telephone company offered the telegraph company $10,000 to take the instruments out of the office. The offer, however, was refused.

It would appear, too, that the Western Union Company is going actively into the telephone business. The Davenport, Ia., *Democrat* of April 2 says that the following notice has been put up in the telegraph office there:

"The Western Union Telegraph Company is prepared to furnish individuals, business firms, corporations and public and private institutions with *private wires* fully equipped with telephones and the necessary call bells and batteries.

"Applications for such services, specifying the points between which the wires are desired and the number of places to be connected, should be made at the company's office at the place where the service may be required."

The only explanation given by the local telegraph manager is that he received the notice and was told to push it.

The Cloven Foot Peeps Out.

General Superintendent Zeublin, of the Baltimore & Ohio Telegraph Company, during the recent riots in Cincinnati, on account of the murderer Berner trouble, looped the B. & O. wires into Governor Hoadly's office in Columbus, O., giving the Governor direct telegraphic communication with the civil and military authorities in Cincinnati.

Governor Hoadly, by the way, is president of the Baltimore & Ohio Company in Ohio, and his firm, Hoadly, Johnston & Colston, were the counsel for the B. & O. Co. in the recent injunction suit against the New York, Chicago & St. Louis Railway Co., tried March 24th in Cincinnati, before Judge Baxter, of the United States Circuit Court, which was decided in favor of the Baltimore & Ohio. A peculiar circumstance connected with this case was that although the suit was against the Nickel Plate road, and the Western Union Co. were not in any way connected with it on the records, yet Gen. Wager Swayne and his brother Frank B. Swayne, of counsel for the latter company, were the only counsel who appeared for the railroad company, showing that the Western Union Co. were the real parties in interest against the Baltimore & Ohio Company.

Protection of Electrical Conductors.

A joint meeting of the Polytechnic Society of the American Institute and the New York Electrical Society was held at the Cooper Union on the 10th, when a paper was read by Mr. Pendleton on the above subject, dealing chiefly with electric light conductors. Dr. Van der Weyde discussed the requirements for the protection of conductors, and Dr. N. S. Keith considered the various modes of protection by means of insulation, fusible and electro-magnetic cut-outs.

American Institute of Electrical Engineers.

The following names have been signed to the call for organization, in addition to those printed in our last issue. We understand that the use of the rooms of the Society of Civil Engineers, East Twenty-third street, has been generously given, and that a preliminary meeting of organization will be held early next week.

Prof. F. A. P. Barnard, President Columbia College.
D. H. Bates, Pres. B. & O. Tel. Co.
Charles E. Buell, Electrician, New Haven.
George F. Bulen, Gen. Supt. Autom. Fire Alarm and E. Co.
Prof. C. F. Chandler, Columbia College.
Jos. P. Davis, V. Pres. Met. Tel. and Tel. Co.
Prof. A. K. Eaton, Electrician, Brooklyn.
Prof. Thomas Egleston, Columbia College.
Edward H. Goff, President Amer. Elec. and Ill. Co., Boston.
Robert Hewitt, Jr., Treas. Telemeter Co.
Prof. F. R. Hutton, Columbia College.
Thomas D. Lockwood, Electrician Amer. Bell Tel. Co.
Prof. J. S. Newberry, Columbia College.
Prof. J. K. Rees, Columbia College.
Prof. Elihu Thomson, Electrician Thomson-Houston E. Co.
Prof. W. P. Trowbridge, Columbia College.
Prof. J. H. Van Amringe, Columbia College.

Lighting English Gun-Powder Mills.—Gun-powder mills near Kendal, England, are now lighted by electricity. The works are about two miles in length, each dangerous building being about 200 yards from its neighbor, and the dynamo electric machine is placed about the centre. Bare wires conduct the current on poles and trees having insulators to Swan incandescent lamps, each building having four to eight of them. The lights are inclosed in specially designed copper reflectors, which project the light through tight-fitting hermetically-sealed windows into the interior of the buildings.

The Drawbaugh Telephones.

The claims of Daniel Drawbaugh, of Eberly's Mills, Pa., to the priority of invention of the telephone have several times been referred to in THE ELECTRICAL WORLD. His claims, as is well known, are upheld by the The People's Telephone Company, who have adduced evidence of an interesting and in a certain way, extraordinary, nature, in their defense, in the suit for infringement brought against them by the American Bell Telephone Company and still pending in the New York Circuit Court. Mr. Drawbaugh places the date of his first conception of

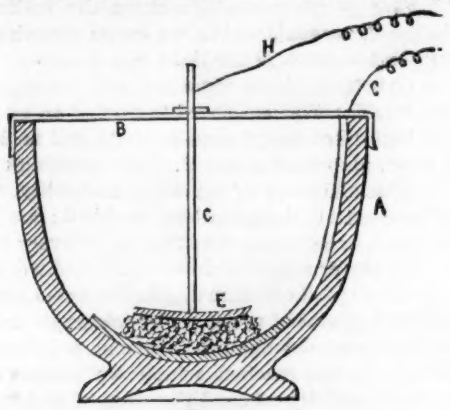


FIG. 1.

the electrical transmission of articulate speech as far back as 1860. He claims that electric telephony had been an accomplished fact with him for a dozen years when Bell, Edison, Gray and the other claimants came upon the scene. The telephonic apparatus said to have been used by him has been produced in court, and witnesses to the number of one hundred and forty-five appeared, who identified and picked out the instrument or instruments which they had seen and heard speak, in Drawbaugh's shop, between 1867 and 1876. In this there is nothing extraordinary; but what is exceedingly strange, however, is the fact that these forms of apparatus all bear a more or less striking resemblance to the practical forms of telephonic apparatus that have been used by Bell and others, and introduced in common use. It would appear, in fact, from the study of these instruments that not only had Mr. Drawbaugh invented the art of telephony before

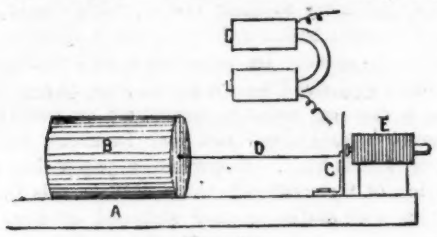


FIG. 2.

1876, but that he had exhausted every one of the resources of invention which have been drawn from by subsequent inventors in their aim to improve the art. For ourselves, we admit that these wonderful coincidences have taken our credulity rather by surprise, and left us rather skeptical in presence of this vast array of testimony. We have therefore preferred to let others speak first, whose disinterestedness cannot be questioned, and we have purposely deferred giving a description of these instruments until the present time, when we can express our own views by quoting the comments of some of our European contemporaries.

The earliest form of Drawbaugh transmitter, said to have been used in 1866, is represented in Fig. 1. A flexible cover *B*, of membranous material, is stretched over the top of a china tea-cup *D*. In the bottom of this cup is a mass of powdered material *F*, resting on a metallic plate, to which one electrode is attached. A metal rod *C* extends down from the diaphragm *B* to a plate *E*, that rests upon the powdered mass, for

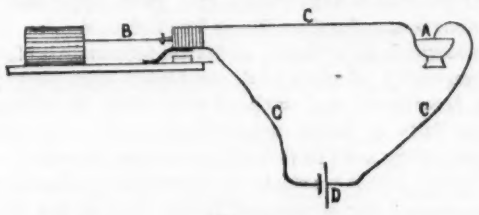


FIG. 3.

which Drawbaugh is said to have used many substances—bronze powder, finely divided metal, fine earth, etc.—though he ultimately adopted plumbago, pulverized charcoal and other forms of carbon. This transmitter is substantially like the Edison carbon-button transmitter, and resembles even more closely the modification made by Signor Righi. The receiver (Fig. 2) used with this transmitter differs only in a few details from the first receivers used by Bell. An old mustard can *B*, of tin, fastened on its side to a base board *A*, is provided with a membrane, *C*, connected by a string *D* with an armature *F*, supported by a spring *C*, so as to be in front of the two poles of an electro-magnet *E* of U form, made of a coil of insulated wire wrapped around a bent piece of iron. The connections were made as in Fig. 3.

In the apparatus of 1867–68, some improvements are noticeable. The transmitter (Fig. 4), made of a jelly tumbler, was provided with a wooden mouth-piece *B*, which is of a form familiar to us all, and the carbon powder was suspended in a tray by the connecting wire *d' d*. In the receiver (Fig. 5) the armature plate was fastened to the membrane itself instead of being connected to it by a

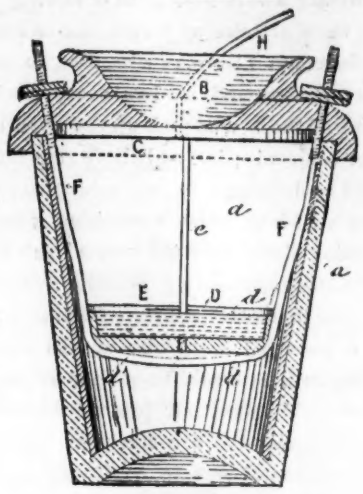


FIG. 4.

string. This form is identical with a receiver made by Bell in 1876.

It was not until 1870, it seems, that Mr. Drawbaugh produced a telephone capable of working without a battery by employing a permanent magnet. This instrument,

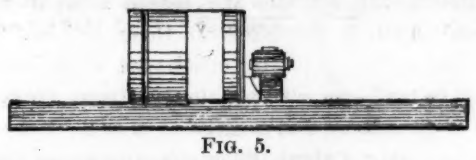


FIG. 5.

shown in Fig. 6, is substantially like the "lecture model" used by Bell in 1877. Toward 1874 Mr. Drawbaugh would seem to have returned to the use of an electro-magnet excited by a battery. This apparatus is provided with means of

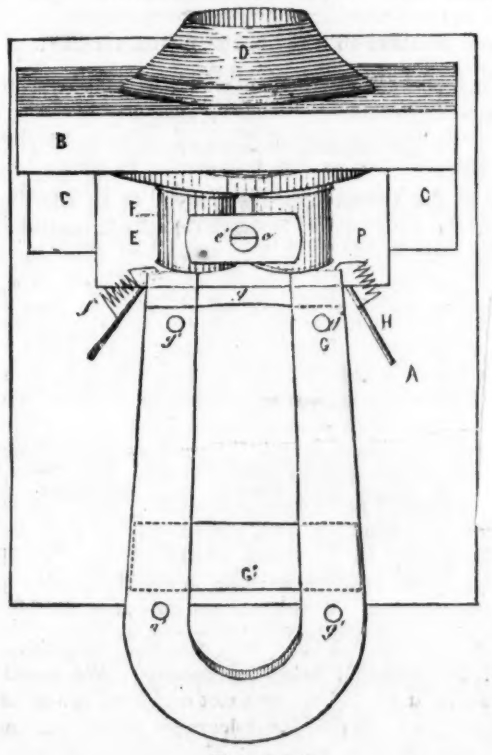


FIG. 6.

adjusting the electro-magnet. This form (Fig. 7) is said to have been preserved complete and to be still in excellent working order. In 1875 the receiver had become transposed into the form shown in Fig. 8, which is almost identical in all details with a form of receiver commonly used

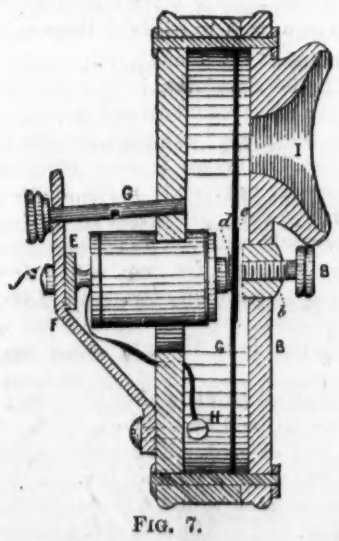


FIG. 7.

here and abroad. The magnet *D* is made of spiral form, and the core *C* inside the wire coil *F* is made adjustable by means of a screw. In 1876 appeared a very perfect and compact form of carbon transmitter (Fig. 9).

A plate diaphragm was used, and instead of loose carbon powder blocks of hard retort carbon were employed. Finally, during the same year, Mr. Drawbaugh had given a practical commercial form to his apparatus. He had placed his transmitter in a box (Fig. 10) suitable to be fastened to the wall and provided with a bell. What is more, he had put in an induction coil. This was, in short, the Blake transmitter almost as we find it to-day. All these improvements, it is said, were in perfect operation at Eberly's Mills in 1876, even while Prof. Bell was trying to make his crude apparatus reproduce a few incompleted syllables. Of course in the face of one hundred and forty-

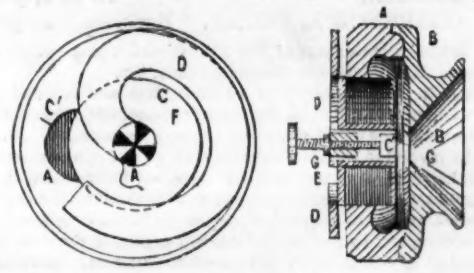


FIG. 8.

five witnesses there is not much room to doubt, but, as a correspondent to the London *Electrical Review* says:

"It seems almost incredible that the electric telephone, 'the greatest marvel hitherto achieved by the electric telegraph,' should have been conceived and brought to perfection by one man, and that man an uneducated workman, living far distant from the world of thought and action, and the whole accomplished within a period of ten years."

Our French contemporary. *La Lumière Electrique*, says: "If this story had happened some fifty years ago we could easily conceive that an inventor, removed from the centres of scientific and commercial life, might have produced wonderful inventions unbeknown to the outside world except to his immediate surrounding. But the thing is almost inadmissable in our day, when reports spread with prodigious rapidity. We cannot admit that Mr. Drawbaugh and his friends had not even a slight notion of the rapid progress of telephony."

An Italian electrical journal, *Il Giorno*, says: "In fact,

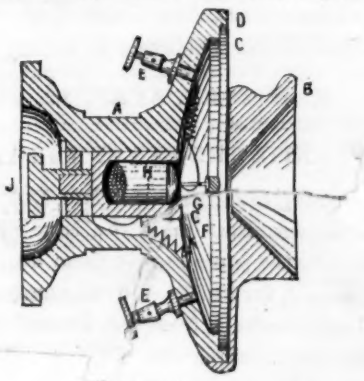


FIG. 9.

the resemblance of the Drawbaugh apparatus with that now in use gives rise to suspicions as to the date of their invention—suspicions which the silence held concerning these instruments certainly does not dispel; and it seems to us that the extraordinary claims of Mr. Drawbaugh need more ample confirmation."

The above cuts we reproduce from our various European exchanges, having seen the original drawings ourselves here. Later inventions of Mr. Drawbaugh have been illustrated in our Patent Record. ***

Underground Devices.

The General Committee on Underground Electrical Communication met in the Boreel Building, on April 4.

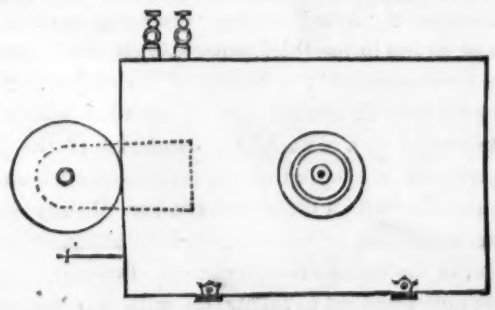


FIG. 10.

The sub-committees on Electrical and Mechanical Devices, Law and Franchises, and Business Organization embodied their views in a detailed report, giving classified and technically scientific information about all the systems ever invented or devised in this or any other country. The merits and demerits of thirteen different systems were minutely considered. The document was a condensation of a year's correspondence, covering thousands of pages, arranged by Mr. William C. Behrens, the electrical expert. The report was sent to the printer, and a copy will be forwarded to each member of the committee for study before another meeting. It is said that the committee hope that before the bill passed by the Senate of the New York Legislature can be adopted by the House, to be able to offer some suggestions that will prevent anything rash being done.

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NEW YORK, APRIL 12, 1884.

UNTIL THE END OF THE YEAR.

Those wishing to subscribe for THE ELECTRICAL WORLD from the present time until the issue of December 27, 1884, can have the paper sent to them during that period, postage prepaid, for $1.50. We can supply a few complete sets of back numbers from the beginning of the year to such as prefer having the file for 1884 complete. A remittance of $2 will cover the expense of the back issues and also of the remaining copies of the year. Present subscribers will oblige by calling the attention of non-subscribers to this matter, and endeavoring to secure a few subscriptions for us, either for the year at $2, or from April 5th until December 27th, 1884, at $1.50.

THE STUDY OF ELECTRICITY AND MAGNETISM.

We publish in this issue the third installment of Mr. William Maver, Jr.'s, "Electrical Information for Beginners." It treats of the correlation of the physical forces, and brings the series of articles down to a very interesting stage. Mr. Maver began with an introductory and historical sketch of electricity and magnetism. This led him naturally to a consideration of "force" and the "conservation of energy," and now he has in the third paper said all that is necessary in the development of this branch of his subject. The articles have been illustrated so as to assist the memory and understanding by a pictorial representation of the principles involved. We think that the readers who have studied these articles with a desire to learn can already give an intelligent account, or have in their own minds a clear conception, of the various manifestations of energy in nature, and are now prepared to follow up with whetted mental appetite the explanation and application of the fundamental laws, as outlined for them, of electricity and magnetism. They are now able to pass easily from the magnificent generalizations of pure science to the elucidation of the phenomena brought under notice in their practical daily work.

When we made our arrangements for the publication of these articles we felt that they would meet the necessities not only of those who wished to begin the study, without any preliminary acquaintance with the subject, but of many others who have been launched into practical electrical work, by the sudden outgrowths of recent years, and are conscious of hindrance from the fact that they never mastered the elements. We are glad to learn from various quarters that we are doing good in this way, and that the demand we suspected exists everywhere to no small degree for popular scientific writing that is accurate and has a definite aim.

While we are aware that there is already a wide appreciation of these articles we would like to know that even more beginners and learners were able to profit by them. We reach ten thousand readers every week, directly, to say nothing of those who pick up the paper casually going around, or borrow it; but we believe that hundreds of persons would be delighted to get hold of this series. They are feeling a wish to know something about the science, or are groping along with their own light, trying unfruitful experiments and reading obsolete text-books; and for them to come in contact with the fresh thought and treatment of a practical man who speaks plainly and uses homely illustrations would be at once a boon and a revelation to them. We want our present readers to help us to reach their friends who are likely to appreciate the articles. We will send sample copies to any address they name, or will furnish them with free copies for distribution, and we will readily reciprocate any little kindness of this kind.

We know of no better or cheaper way in which beginners can gain familiarity with first principles and qualify themselves for deriving full benefit from the regular manuals than is presented in these articles. In case therefore the two preceding articles are wanted—and they should be read—we will send them without charge on receipt of the subscription mentioned in our special offer, or, if desired, we can supply a few complete sets of the paper from the beginning of the year, in which case the annual subscription should be forwarded. The price of the paper is so low that no one can say that it is beyond his means; and this opportunity is one not to be missed.

PRINCE BISMARCK'S LAMENT.

We had an idea that it was the American hog, or Thomas Porterhouse Ochiltree, that had brought Prince Bismarck into his present state of nervous debility. But the great Chancellor has vouchsafed to give an explanation, and he lays the burden on the telegraph. "My nerves are in bad condition," he says, in furnishing reasons for his withdrawal from the Prussian ministry. "I have not time to be unctuous. The telegraph fearfully multiplies my work. Germany is interested in whatever happens in the capitals of the world, and it is necessary to act rapidly upon information telegraphed in haste."

The Prince is to be pitied, but it is evident, as he admits, that there is no escape, save resignation of office, from the existing conditions of social and political life, in which the telegraph and telephone now play so important a part. It is in vain that he laments over the extra work entailed on him by the means of rapid communication. The days of such diplomatic unctuosity and ponderosity as were described by Mr. Motley in his story of the struggle of Holland against Spain, or more recently in the Metternich papers, are gone forever. With them are gone, too, the days when bloody battles could be fought by remote forces, long after peace had been ratified, and when rustics would drink the king's health months after he had been moldering in his vault. The world no longer lies like a lumbering whale whose nerve centres and brain are slow to tell him that he has been harpooned, but all the members respond to influences exerted on any one of them, with the sensitiveness and promptitude of the most highly wrought organisms. Hence the statesman has to live on a higher plane of activity, decide promptly, act rapidly, and measure the popular currents of thought and feeling with the instantaneous accuracy of a galvanometer.

It is noteworthy that just at the time when Prince Bismarck complains of the strain put upon him by the telegraph, the English *Spectator*, in its philosophical way and in keeping with other recent utterances, expresses the opinion that the telegraph "probably produces more misery than it relieves," although it adds, somewhat illogically, that to those who appreciate rapid communication it is mainly an enjoyment. We question very much whether the *Spectator* could establish its opinion as to the misery caused by the telegraph, for we take it that everything which can knit a community together, cause a rapid interchange of sentiment and ideas, annihilate distance, isolation and prejudice, is of the greatest good to the largest number.

But the practical point is that the telegraph and telephone are with us, and that though high civilization, like the Grecian, has existed without them, they are factors we must all deal with in modern life. If they were taken away to-morrow men would still be able to lead virtuous and happy lives, but we think that the public would suffer from a terrible feeling of deprivation, as it now does when there is a long strike of operators or the wires are down. We have to contemplate a society that has learned to use the telegraph and telephone, and finds them very desirable as means of communication. On the whole, we maintain, the use of them has been beneficial. Bismarck himself, although he complains, has no doubt got great satisfaction and enjoyment out of the rapid communication of his plans and wishes to his agents and the feeling that in a few seconds he could make his influence felt in any capital; and while the London *Spectator* avows its low estimate of the benefits of the telegraph another great journal in the same city is expatiating on the delights of the promised telephonic service between London and Brighton, by means of which "you will be able to bask in the sunshine of the Marine Parade and chat to your managing clerk in the fog of the city." Few people nowadays share the feeling of the Boer in the Transvaal, whom we quote elsewhere as regarding the telegraph in the light of a nuisance, and railroads as no better. Aside from the enjoyment, there is, too, the consideration whether life carried on by sustained effort at high pitch is not more to be desired for itself than a dull, slow, monotonous round. The running of express trains implies efficiency of service, punctuality, the finest type of locomotive, the smoothest road-bed; concentration of skill and experience, the knitting of every nerve and energy, the performance of downright good work straight along the line by all concerned. In the same manner the dispatch and receipt of messages by telegraph or telephone implies the higher development of social, political and commercial life, having reached which we cannot afford to look back regretfully on conditions out of which we have risen.

"EXCHANGE" ETHICS.

Never buy a copy of a picture, is the blunt advice of John Ruskin. "All copies are bad, because no painter who is worth a straw will ever copy." He makes a neat application in saying: "Whenever you buy a copy * * * you encourage a dull person in following a business he is not fit for, besides increasing ultimately chances of mistake and imposture." With the same application we would amplify the advice and say: "Never buy a paper that copies directly from another, or that plagiarizes, with the intent to make the matter appear original."

This test of originality is a very good one to apply to the merits of a paper, unless it is openly and designedly a compilation from others. A paper publishing large numbers of original articles can often do its readers a great service by bringing to their notice, with due courtesy of acknowledgment, articles that appear in other papers they are not likely to see. In this way it will usefully supplement and round out its own work, just as a good writer will add to the force of his argument or narrative by an apt quotation; and it will not lose in merit by judicious transfers of this kind. But when a paper has so poor a conception of "exchange" ethics, that it fills its columns habitually with stolen matter stripped of the means of identification, it shows very plainly that it is in a business which would be well rid of it.

The morality exhibited by some papers in this practice of using matter from their contemporaries is painfully lax, and if they betrayed similar confusion of mind in regard to the ownership of other property they would soon find themselves in the grasp of the law. It is not merely the acknowledgment of little items that are tossed about like flotsam and jetsam in the sea of journalism, and that nobody cares to lay claim to. To determine where a scrap of news or information originated is often difficult, and the man who abstains from using it until he can ascertain its authorship is devoid of the journalistic instinct. But when the article is of any length, involving research, thought, experience, statistical skill, time and expense, it is generally easy enough to know what is its source; and to take that article and reproduce it without a single word of credit or attribution is the worst kind of literary theft. It is true that the papers indulging in the practice "convey" in a wholesale manner, so that if they were to acknowledge the origin of their contents they would present a very cheap and poor appearance; but that does not make the offense less heinous.

The English *Electrician*, of March 29, names a New York contemporary of ours and complains that that journal picks frequently and without stint from its columns but always fails to make acknowledgment. Our esteemed contemporary says that such procedure is called stealing in England and it wants to know what we call it here. We beg to assure our aggrieved friend that it has the same ugly name among all honorable American journals, most of which suffer, too, from the depredations of these literary thieves. We ourselves as victims of the practice have about as much cause as anybody to complain, and when we see the *Electrician* aroused because only four of its items were coolly appropriated by our contemporary, we cannot refrain from telling it that it has been lucky. We have before us now two recent issues of an English contemporary. In one of them two headline articles and nineteen paragraphs of ours are used without a single syllable of acknowledgment. In the other, four headline articles and ten paragraphs of ours are used with an equal amount of courtesy. In a third paper of later date, an editorial of ours is cut up—hashed—into four items of gossip, with other matter, and at the foot is the *nom de plume* of some writer who thus palms it off on unsuspecting readers as his own. Well, this is very flattering, but we would rather have straightforward compliments. The other day an Italian electrica

paper came into our hands, and on reading it we discovered that three of its most important items hailed from this office, but were not so introduced to the Italian public. A French paper has lately had unacknowledged reproductions of several of our articles and more of our cuts.

So we might go on, for one can hardly take up an electrical paper, home or foreign, without finding in it some articles or items that originated in THE ELECTRICAL WORLD. When they are not acknowledged we find little difficulty in detecting them, as our contents are largely original and almost everything going through the paper gets our "stamp" on it. Unquestionably THE ELECTRICAL WORLD is a rich mine for exploitation. When, therefore, we see an article taken from this paper without credit we are not surprised, and we have long ceased to worry about it. We are glad to know that so much of our matter is deemed worthy of republication. We know of no cure for those who avail themselves freely and without thanks of our enterprise except a total change of heart and a general reconstruction of head.

ELECTRIC LIGHT FINANCING IN ENGLAND.

It appears from statistics recently collected that out of ninety-one electric light companies started in England from the end of 1878 to the close of 1883, only eight are now quoted on the London Stock Exchange. The epidemic of insolvency has virtually swept away all the sickly corporations raised in a hot-bed of excitement and enthusiasm, and has spared the Anglo-American Brush, the parent Brush company, the Hammond, and the United Edison and Swan companies, which are practically left in possession of the whole field. This is a striking exhibit of disaster, and of course the pessimists and the opponents of electric lighting are enjoying a glorious time over it. We are told that the electric light is a fraud, and that the English public has been gulled by a set of swindlers.

Those who infer from the record of electric lighting in England that the case has become hopeless, arrive at conclusions that the facts do not warrant. Some experience of the kind was inevitable in connection with a new business development like electric lighting, and it is by no means without precedent. It is not so long ago that Hudson, the "railway king," worked all England up to a tremendous pitch of excitement over railways. New lines were mapped out and new companies formed daily. Hudson hobnobbed with dukes, became lord mayor of York, was elected to Parliament, made his half-a-million dollars or his million whenever he felt like it, and, despite the ferocious grumbling of Thomas Carlyle, was to have had a statue at a cost of not less than $125,000, that sum being actually subscribed. Then the collapse came, Hudson was dethroned and driven into exile, the projected roads were abandoned, and thousands of people were ruined. There were not wanting people to cry out that railways were a fraud, and that the dear public had been swindled. We need hardly say that the railway survived this gigantic disaster. Since that time it has done for England far more than the wildest speculators then anticipated.

We would like to sympathize with the deluded British investor, but in doing so we feel that he has nobody to blame but himself for his troubles. He persists in putting his money into all sorts of enterprises without the least inquiry, and as a result he is very often a heavy loser. He is a victim of crazes. At one time he sinks his capital in Turkish bonds or Egyptian; then he tries the securities of half-fledged South American States. Never satisfied with the sweet simplicity of the three per cents, he dabbles in Chinese tea estates, Ceylon coffee plantations, East Indian gold mines, Australian sheep-walks, South African diamond diggings, Florida real estate, or Western cattle ranches. Each of these for the time being monopolizes his attention as a "sure thing," but when from mismanagement even the best of his ventures fails, the British investor still complains that he has been fleeced. Whose fault is it?

All we have to say is that it is utterly unreasonable to charge these financial difficulties to shortcomings of the electric light. It would be as logical to attribute the late speculative panic in wheat to an alleged low grading of the crop of 1883, or to say that because the Dutch once, to their cost, gambled madly in tulips, the flower was necessarily unworthy of cultivation. The fact remains that in spite of all this speculation the electric light has become an undeniable commercial success since 1878 and has in many respects improved. England has been as slow to appreciate the electric light as it was the telephone, but the former is as much an established fact now as the latter. Meantime in this country the financing has been in abler hands, and the light, arc or incandescent, is in such favor that not a week passes, regardless of the prolonged depression in trade and industry, without seeing two or three large installations completed. One arc light company alone has about 30,000 lamps in constant use all over the country, and as far back as last October the Edison Company for Isolated Lighting had installed 246 plants aggregating 61,366 lamps. These figures in all probability do not cover one-fourth of the arc and incandescent lighting today, but an idea may be formed from them of the value of the pessimistic criticisms called forth by the sorry show of financial blundering and plundering in England, and of the extent to which we are beginning to use the light here.

Electrical Information for Beginners.

BY WM. MAVER, JR.—PART III.

The Correlation of the Physical Forces.

Sir Wm. Armstrong in an address before the British Association for the Advancement of Science, in 1863, referred to the discovery of force correlation as the most important discovery of the nineteenth century.

To enable us to understand more fully what is meant by force correlation, or the mutual convertibility of the forces, let us first consider some things with which we are all familiar and which we know to be mutually convertible, or correlated to each other; for instance, ice, water and steam.

We know that if we have ice we can by the use of proper means produce water, and, having water, we can produce ice. We also know that we can convert water into steam, and can convert steam again into water by condensation.

This is proof of the correlation, or mutual convertibility of ice, water and steam, the fundamental substance in

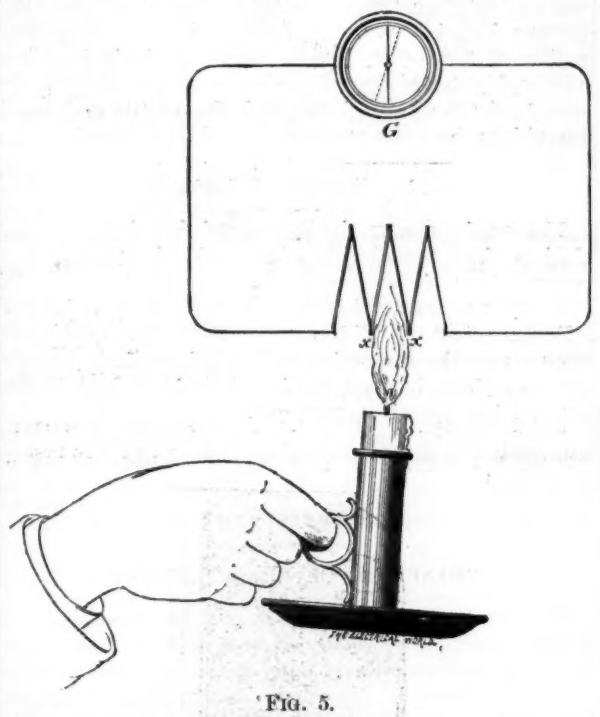


FIG. 5.

this case being water (leaving out of consideration the chemical composition of water).

Now, we have so often seen these processes of water freezing into ice, and ice melting into water, and water being heated into steam, and steam again condensed into water, that we have, without questioning, come to look upon these substances as correlated, and yet these substances are entirely different in outward form and also in action.

If, therefore, we find other substances, or forms of energy equally convertible one into the other, and can show that there is one fundamental substance, or form of energy essential to the production of any of the others, it is but logical to assume, even though we do not know the exact nature of the substances or the forms of energy, that they are all of the same origin.

If this correlation can be shown in the case of electricity and magnetism—heat, light, chemical action and motion—it should certainly, if nothing more, enable us to go on with the study of the sciences in a more comprehensive manner.

I shall, therefore, now try to collect the evidence tend-

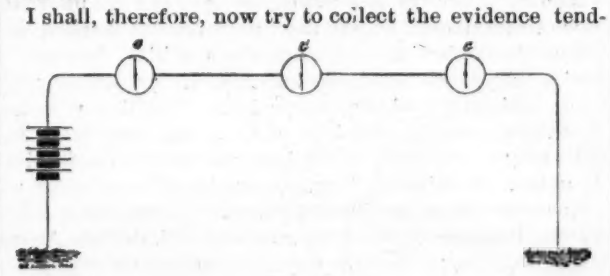


FIG. 6.

ing to prove the correctness of this theory with regard to these forms of energy.

It is known that we can convert electricity into magnetism and magnetism into electricity in the manner already mentioned (Part I.).

We can convert heat into electricity by means of a thermo-electric battery (heat-electric battery) as shown in Fig. 5, in which are different kinds of metals—for instance, bismuth and antimony—joined together, and the terminals of which are connected, as shown, by a piece of wire forming a circuit. In the same circuit is inserted a galvanometer *G* which will indicate by a deflection of its needle that a current of electricity is flowing through its coils. If heat be applied to the points of junction of the metals a deflection of the needle of the galvanometer will be noticed, showing that heat has in this case produced electricity.

In this relation I may remark that among the most, if not the most, sensitive heat detectors which can be made are thermo electric piles; which are sometimes made by joining alternately many thin and small strips of copper and iron, each separated or insulated from the other, except at the point of junction. When such a pile is placed in circuit with a very delicate galvancmeter, the latter will show the presence of the heat that radiates from a hand which is merely passed over the pile.

We know also that electricity will produce the most intense heat, as, for instance, that generated between the carbon points of an electric light.

Here, therefore, is the mutual convertibility of heat and electricity shown.

The conversion of electricity into light, as exemplified in the electric light, is well known, and we might by converging the rays of sunlight upon the metals of a thermo-electric pile or battery, and thus by producing heat, and from this heat generating electricity, thus show the conversion of light into electricity.

But that is not necessary, as there is a more direct evidence that light is convertible into electricity. For instance, if in place of the joined pieces of bismuth and antimony in Fig. 5, we were to place a piece of the mineral selenium, and were to place this selenium in a closed box, on opening the box and allowing light to surround the selenium a deflection of the galvanometer needle would be noticed; showing the conversion of light into electricity.

Another instance that light is convertible into electricity is furnished by a recent invention. This invention consists of a battery containing a solution of 15 parts of table salt and 7 parts of a sulphate of copper in 106 parts of water. In this is placed a porous cell filled with mercury. A circuit similar to that shown in Fig. 5 is then led from the mercury to the salt solution and a galvanometer, as in Fig. 5 is placed in the circuit. When the battery is placed in the sunlight a deflection of the galvanometer needle is noticed, thereby showing the presence of an electric current. When the sun is clouded or any other change in the intensity of the light occurs, it is indicated by the needle. It is not as yet known in what way this effect is produced by the light rays, but their necessity for the production of electricity by this battery is manifested by the fact that it only acts when in the sunlight.

The correlation of chemical action and electricity can be very readily shown in the case of those systems of telegraphy known as chemical automatic systems. For instance, when the current of electricity through the wire is the result of chemical action in the battery cells (which I shall describe more fully later on), the marks on the chemically prepared receiving paper are the result of what is called the electrolytic action of the electric current as in passing through the paper it decomposes the ingredients of the chemical solution with which the paper has been previously moistened.

That electricity is a mode of motion can also be proved, for if we arrange a long wire as in a telegraph circuit, and at intervals along this wire insert galvanometers (Fig. 6), we shall notice upon connecting a battery to one end of the wire that the needles of the galvanometers are deflected, one after the other, showing that the current has *moved* from one end of the wire to the other end. That electricity can also be produced by motion is a well-known fact. The simple placing of a coil of wire in front of the poles of a magnet will not generate a current of electricity in the wire. The coil must be revolved in front of the magnet's poles, or the magnet must be rotated around the coil to produce electricity. Neither will the simple presence of electricity in the coil of wire which is wound around the bar of soft iron, as in the ordinary telegraph relay, produce magnetism in the bar. The electricity must be in actual motion to do so. In short, electricity cannot be produced without motion of some kind.

Heat is also a mode of motion. For instance, if we place one end of a poker in the fire, we can trace the heat as it moves along the iron.

Chemical action or change is also a mode of motion, for no chemical effect can be caused without a movement of the particles of matter, and it is also a result of motion. It requires a current of electricity to accomplish chemical action in an electrolytic cell.

Magnetism is also a mode of motion, and we know that in magnetizing a piece of iron the magnetism seems to travel from particle to particle, and it has been demonstrated that it requires the one-sixteenth of a second to magnetize thoroughly a magnet of the size generally used in telegraphy.

We have thus seen that *electricity* is convertible into heat, light, magnetism, chemical action and motion; *magnetism* into electricity and motion; *chemical action* into heat, electricity, light and motion; *heat* into electricity, light, chemical action and motion; *light* into electricity, heat and chemical action; and *motion* is convertible into chemical action, electricity, heat, light and magnetism.

It therefore appears that none of these forms of energy can be produced without motion, while motion always appears to bring into existence one or other of these forms of energy.

Motion would therefore appear to be the fundamental cause of all of them.

It is impossible to conceive of *motion* without presupposing that something is being moved.

It is easy to understand what is meant by the motion of a tangible substance—such, for instance, as the motion of a train or a wagon, or the molecules of water, etc.—but it is more difficult to comprehend or to fathom what it is

that moves when, for instance, we speak of the motion of light, heat, electricity, etc. If solar light and solar heat are forms of motion and their source is the sun, as their names imply, there must needs be a medium through which this motion takes place, and this medium, whatever it may be, has been named ether. This ether is supposed to permeate all space and all substances.

Sir Isaac Newton endeavored to compute the density of ether and found that it must be at least 700,000 times less heavy than the air we breathe, and compared to it our air would be far denser than a solid mass of granite.

It has been further supposed by scientists that it is the rate of motion or vibration of the particles of this ether which gives us the phenomena of light, heat, etc. In fact, the rates of undulations of the ether necessary to produce these phenomena have been mathematically calculated.

Thus when the vibrations of the ether do not exceed four hundred and fifty millions of millions per second, the phenomena of heat is produced. Beyond that rate and below seven hundred and twenty-seven millions of millions of vibrations per second the various tints of light are produced. It has also been shown that the different tints of light are produced by variations in the length of the *wave* of the vibrations, while if the vibrations exceed that number, light is replaced by the actinic or chemical phenomena.

Now, whether electricity and magnetism are distinct from this ether or whether their presence depends upon the ether assuming vibrations or movements differing from those producing light, heat, etc., in length, velocity or otherwise, is as yet unknown.

Many investigators, however, in late years have thought that electricity is a mode of motion of a higher order than either light or heat, and, if we may reason by analogy, it is not difficult to come to some such conclusion.

In the illustration of ice-water and steam it was, I think, well understood that ice and steam, though quite different in form from water, are nevertheless water subjected to different degrees of heat.

Now, if we should find that by some peculiar application of heat to water we could develop a substance differing from either ice or steam, we should naturally suppose that this strange substance was yet water in another form of heat. The more so if we found that this new substance were again convertible into ice, water or steam.

In like manner, then, do the advocates of the theory that electricity is a form of motion reason.

They have found, for instance, that light and heat are forms of motion, and that these forms of motion are correlated to electricity, as already shown, and therefore they conclude that electricity is also a form of motion.

But physicists do not rely altogether on the analogy of the correlation of the forces, for in their researches they have found that especially between light and electromagnetism there are many points of similarity, which I shall not enter into here. (I would, however, recommend the reader, who is desirous of obtaining further information on this subject, to get Gordon's lectures on Static Electric Induction, procurable, I believe, through THE ELECTRICAL WORLD office.)

On the other hand there are those who still think that the true revelation of the nature of electricity will show it to be a material substance.

(TO BE CONTINUED.)

The Use of Iridium in Electrical Appliances.

It is strange that a metal for which the uses are innumerable on account of its hardness should not have been known before 1803, but it was only in that year that the discovery was made, and it is only within the last few years that the metal has been employed to any extent in the arts. Prof. Wm. L. Dudley, in a paper read at the Cincinnati meeting of the American Institute of Mining Engineers on the iridium industry, reviews the history of the metal. He says that in attempting to fuse iridium it had been found by experimenters that the best results could be obtained by means of the oxy-hydrogen or electric furnaces. With either of these means the quantity of metal that could be worked at one time was very small. About four years ago Mr. John Holland, the gold pen manufacturer of Cincinnati, found that by heating the ore in a Hessian crucible to white heat, adding phosphorus and continuing to apply heat, the metal was perfectly fused and could be poured out and cast into almost any shape. The presence of the phosphorus, however, rendering the metal easily fusible at a white heat, interfered with its use for electrical purposes. It was found that by heating the metal in a bed of lime the phosphorus could be completely removed. In this operation the metal is first heated in an ordinary furnace at a white heat. When no more phosphorus makes its appearance it is removed and placed in an electric furnace with a lime crucible and there heated until the last traces of phosphorus are removed. The metal that remains will resist as much heat without fusion as the native metal.

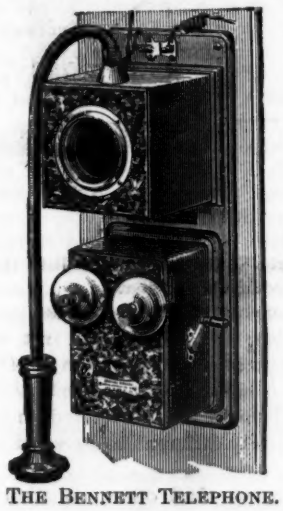
He speaks hopefully of later processes for plating iridium on base metal, upon a commercial scale, and says further: Some years ago experiments were made in order to apply the metal to the electric light; we found that an iridium electrode used upon the negative of an arc light would keep its shape and resist the heat, provided the positive carbon which was used with it was not allowed to strike or fall too heavily upon the iridium negative, as the metal at a white heat becomes malleable, and by this continual pounding or striking the negative would gradually become misshapen. The iridium negatives are made by setting a piece of dephosphorized iridium in the end of a brass rod about 6 inches long and $\frac{9}{16}$ inch in diameter; the length of the iridium tip is about $\frac{1}{2}$ inch, ground conical in shape. It was found that the brass, being only $\frac{1}{2}$ inch from the arc, would resist the action of the heat, but in some cases where the lamp flamed the brass was liable to undergo partial fusion, and in such cases it was found desirable to put a thimble or cap of platinum over the end of the brass and just below the iridium, the platinum thimble being about $\frac{1}{2}$ inch long.

One of the most important applications of iridium which has yet been made is for the electrical contact points of telegraphic apparatus. These contact points consist of pieces of copper wire tipped with iridium, which are set in the instrument just as platinum points are set. These contacts will outlive many platinum contacts, and are not subject to oxidization or sticking, as are the platinum, and all that is necessary in order to clean them when they become dirty is to pass over their surface an emery file or a piece of fine emery paper. These contacts have been thoroughly tested by various eminent electricians, and also by long-continued use, and the advantages herein stated have been in every case fully demonstrated.

The Bennett Telephone.

The fact is being gradually realized that there is a vast field for the mechanical telephone. At the present time several thousands of these instruments are in use in this country, and the number is daily on the increase between office and store, the different floors of a factory, editorial rooms and the composing and printing offices—between any two places in short that it is desirable to keep in communication for private purposes.

We illustrate below a mechanical telephone of remarkably handsome exterior, and one from which the best results have been obtained. It is the Bennett, made by the Bennett Telephone Company, of Indianapolis, Ind., under several patents dating from June 12th, 1881, down to the present time. These patents cover, broadly, the use of a curved speaking tube in a transmitter, the use of a hearing tube in connection with the telephone, the method of putting up the wires and using magneto bells, and other details. It is claimed that the sound is transmitted very clearly and naturally, and that in the receiver the pulsations are, so to speak, focalized directly on the ear of the listener. There is the great advantage from the use of the two instruments that one need not turn the head to perform the two actions of hearing and speaking, but can as with the present Bell-Blake instrument, carry on conversation without any change of position. The line wire and insulators used are specially made for the company, and the magneto bells are manufactured under the Gilliland patents. Satisfaction is guaranteed in talking over a distance of not more than 2,000 feet. If necessary, half a dozen instruments can be connected in a building. Among those who have tried the apparatus and speak highly of it are the Four-Piece Sifter Company, of Ladoga, Ind.; Chas. Mayer & Co., of Indianapolis, the largest wholesale and retail toy house in the West, and Garr, Scott & Co., of Richmond, Ind., who have three telephones on a line 1,050 feet long.



THE BENNETT TELEPHONE.

The International Electrical Exhibition.

Mr. Louis H. Spellier, the inventor of Spellier's system of time telegraphy, and a member of the Electrical Committee of the Franklin Institute, called at our office this week. We learn that he can be found at the office of the American Watchman's Time Detector, Astor House, where he will be glad to furnish advice and information, free, to all who wish to exhibit at the approaching International Electrical Exhibition at Philadelphia. He is thoroughly posted on the subject, and can give some valuable points to any who are interested in inventions and devices to which it would be well thus to direct public attention. The members of the Electrical Committee of the Institute are Messrs. John J. Weaver, David Brooks, Henry Morton, E. J. Houston, N. H. Edgerton, L. H. Spellier, J. Norris, Jr., Dr. W. H. Wahl, and H. W. Sellers, Secretary.

Electrical Notes in Washington.

Last week we gave a few personal notes on electrical interests in Baltimore. This week we publish some additional items gathered in Washington.

The lighting up of the Capitol, the Smithsonian Institution and the Washington Monument with the Brush light, proved a remarkable success, and it has been a prominent theme of conversation in Washington. Superintendent Sheehy, of New York, was in Washington to see that the work was done in an efficient manner. On the Capitol the lights are placed on the dome, directly under the statue of Liberty. The effect is very beautiful, as is also that of the lights displayed so conspicuously on the top of the monument.

The United States Company has about 150 lamps running in the city, but one hears very little of other electric light companies in Washington. The restrictions on aerial wires are seriously detrimental to electric light interests there, except for private installations.

Washington has been selected as one of the places for conducting experiments with underground wires, and the District Commissioners have exerted themselves to reduce the number of overhead wires. It will be interesting to learn what are the results of underground service there. Col. Rockwell, the Superintendent of Public Buildings and Grounds, has been connecting the public departments, White House and Capitol, by underground wires for telephonic service, and Mr. Hurlbut has been actively employed in carrying out the experiments and operations for the Postal Telegraph Company.

Washington is, of course, the headquarters where patent lawyers do mostly congregate, and the number is steadily on the increase of those who pay special attention to electricity. The proportion of electrical patents issued is now very large. Among the principal patent solicitors devoting themselves to electrical inventions are Messrs. Paine & Ladd, Baldwin, Hopkins and Payton, H. E. Doolittle, Rhesa G. Dubois, T. H. Alexander, W. B. Hale, Frank Janus & Co., and James L. Norris. Mr. C. J. Kintner has charge of Class Electricity in the Patent Office.

Not far from Washington and visible from the top of any tall building in that city is Fort Myers, the signal station. Lieut. J. A. Swift, the author of "The Practical Telegrapher," to which so warm a welcome has been accorded, is now in charge of the station, having been recently promoted. Upon him falls much of the responsibility of instructing the men of the Signal Corps, a work for which his book has shown him to have special suitability.

A company that has made Washington its home, and for which there is evidently a bright future, is the Stabler Signal Company, authorized by the Bell Telephone Company, and selling the Stabler individual telephone call. A long illustrated description of this apparatus appeared in THE ELECTRICAL WORLD of March 8. The advantages of the system in lessening the number of lines, giving facilities for individual calling and practically cheapening telephone service in the long run are too apparent to be neglected or lost sight of.

The National Capital Telephone Company is doing a large business, and its service appears to give general satisfaction to all who use it. Mr. R. G. Du Bois purchased recently the right to the Beecher mechanical telephone for the District of Columbia. The Beecher telephone gives excellent satisfaction, but the prejudice against aerial wires interferes with its proper development in Washington.

The firm of Royce & Marean, 1408 Pennsylvania avenue, has just furnished five miles of wire to the Brush-Swan Electric Light Company. The firm is doing a considerable business in general electrical supplies, including burglar alarms, annunciators, private lines, etc., and also gets not a little work from the various government offices.

Mr. George C. Maynard, who is known to many readers of THE ELECTRICAL WORLD, is now the general manager of the National Electric Company. The company furnishes all kinds of house electrical apparatus, as well as medical batteries and fire alarms. It fits up permanent gas lighting apparatus, and is the agent for the Portable Electric Gas Igniter. Plans and estimates are prepared, and apparatus of all descriptions is operated and maintained.

We are indebted to Manager Marean for his courtesy in showing us over the Western Union office and building, so admirably situated opposite the Treasury, on Pennsylvania avenue. The office is large and convenient, and although the Bankers and Merchants', Postal and Baltimore & Ohio companies are all represented and are kept comfortably busy, the Western Union Company's business is gaining. Mr. Marean reports that while there is an enormous quantity of extra work done during the session of Congress, the regular local business grows rapidly, and more than keeps pace with the increase of population. The District Telegraph Company makes a satisfactory report. Against the Baltimore & Ohio Company, however, there is evidently some little feeling of opposition among good Washingtonians, who assert that it has been the policy of the Baltimore & Ohio Railroad Company to discriminate in favor of the Monumental City to the neglect of the city of Magnificent Distances, and the feeling of resentment in the latter place acts more or less harmfully on the Garrett telegraph interests, so far as Washington is concerned.

THE TELEGRAPH.

RAILWAY TELEGRAPHS.—The annual convention of the Railway Telegraph Superintendents' Association will be held at Boston on Tuesday, June 17.

THE FOES OF WIRE AND CABLE.—According to the *Japan Weekly Mail*, Celestial fishermen cut the cables in Chinese waters in order to steal and sell the inclosed wires. It is said, too, that the natives of Alaska have utilized for fishing the wires that have been abandoned to their tender mercies.

ELECTRICAL STUDY AT BUFFALO.—The Electrical Society of Buffalo, N. Y., held its regular bi-monthly meeting on April 4. The meeting was occupied by the delivery of the first of two papers by Mr. Thomas Henning on Quadruple Telegraphy. The branch of the subject taken up was "double transmission in one direction." The remaining lecture will be delivered at the next regular meeting.

A BOER ON THE TELEGRAPH.—An Englishman was in conversation recently with a Conservative Boer of the Transvaal. The old man objected to modern improvements very strongly: "Then you would not even have a telegraph?" said the Englishman. "No," said the Boer, "what's the use of a telegraph? If the news is good it will keep; if it's bad, it had better not come at all, let alone coming in such a hurry."

"KINKS" IN SUBMARINE CABLES.—To obviate "kinks" in submarine telegraph cables, and consequently render these important means of communication less liable to break when subjected to a strain, Messrs. Trott and Hamilton have adopted the expedient of making each alternate layer of sheathing cross each other. Thus if the inner sheathing of hemp has a right hand "lay," care is taken that the lay of the next sheathing shall be left-handed.

CABLE COURTESIES.—John Pender, member of Parliament, on the 10th cabled to Erastus Wiman, of New York, in response to an inquiry, that the Associated Atlantic Cable Companies would pass free of charge the social messages of the distinguished delegates attending the meeting of the British Association for the Advancement of Science, to be held in Montreal during the coming summer. The association comprises the most eminent scientific men of Great Britain and the Continent, and the meeting at Montreal is looked forward to with much interest as being the first meeting of the association held outside of Europe.

SUMMARY DISMISSAL OF A SUPERINTENDENT.—A dispatch from Denver, Col., says: The action of President Lovejoy, of the Denver & Rio Grande Railway, in summarily dismissing General Manager D. C. Dodge, Chief Engineer J. A. McMurtry and Superintendent of Telegraph P. F. Woodward has created a sensation here. Public opinion is divided as to the justice of the action. General Superintendent R. E. Ricker assumes the duties of general manager, General Freight Agent A. S. Hughes has been made general traffic manager, and R. A. Hutchinson superintendent of telegraph. In an interview President Lovejoy said: "Mr. Dodge's dismissal was determined upon in New York. I anticipated that he might question my authority. The Board of Directors passed a resolution authorizing me to dismiss him."

A DECISION AGAINST TELEGRAPH MONOPOLY.—Judge Baxter, of the United States Circuit Court, at Cleveland, Ohio, has issued a supplementary order in the suit of the National Telegraph Company against the New York, Chicago & St. Louis Railway Company respecting the telegraph line along the Nickel Plate Railroad. The railway company has heretofore refused to transport the telegraph material of the National Telegraph Company and perform other obligations made under contract. The first order of Judge Baxter simply restrained the railroad company from interfering with the telegraph company in its possession and use of the line. The supplemental order preserves the rights of the parties, as defined by the contract between them, and further orders that the railroad company concede to the telegraph company the right and privilege therein stipulated for. The supplemental order is full and complete, leaving the course of the telegraph company clear and its claims fully recognized.

ASKING FOR FACILITIES IN MASSACHUSETTS.—The Committee on Railroads resumed, on the 8th, its consideration of the question whether the locations of railroads shall not be used for the stretching of telegraphic wires. Watson H. Fairbanks, General Superintendent of Construction of the Postal Telegraph and Cable Company, spoke of the rapid growth of the business of that organization, which had already spent about $3,000,000, of which $1,900,000 had been contributed by Mr. Mackay. Mr. F. Dickinson, Jr., counsel for the Postal Company, said that he proposes to show that his clients are acting in good faith, and that they can carry out their plans and supply satisfactory service, which, he claims, is not now provided throughout the country. He denied that they propose to sell out to any other company. Mr. Fairbanks continued that his company desired to use the locations of railroads, as it will be less expensive for it to stretch its wires thus than along highways. As the Western Union Company now practically controls railway lines of wires, there is need of legislation. Mr. Dickinson here put in a proposal of the companies to within five years do all the business of the United States government with all "delivery" cities, its rates to be 25 cents for the first 20 words and 10 cents for each additional 10 words. In the West it is generally cheaper to follow the highways. He stated further that the opposition comes not from the railroad companies, but from the Western Union Company. He has no idea his company will be absorbed as others have been by the Western Union, as it has too much capital for such an operation to be successfully carried out.

THE TELEPHONE.

IN TENNESSEE.—At the last quarterly meeting of the Cumberland Telephone Company, of Tennessee, it was resolved to increase the capacity of the Nashville Exchange to 2,100 instruments. The number of 'phones in use at Memphis has increased since last October from 450 to 675.

N. Y. & PA. TELEPHONE CO.—Improvements have been made at the Jamestown office of this company by Manager W. F. Melhuish, who is at present residing at Salamanca, where he has charge also of the exchange. Among the additions contemplated are public offices at the Junction House, Dexterville, Falconer and Piousville.

MELBOURNE, AUSTRALIA.—The directors of the telephone company at Melbourne, Victoria, have determined to erect new premises for their central office contiguous to Queen street. The apparatus will when complete give connections for 3,000 subscribers, and it is promised that the whole equipment "will make the exchange system one of the finest in the world."

DRAWBAUGH INTERESTS CAPITALIZED.—The Drawbaugh Telephone and Telegraph Companies of the South and Northwest were incorporated by certificates filed in the New York County Clerk's office on April 5. The corporators for the first company are John R. Bartlett, Henry C. Andrews, George C. Gorham, Marcus Marx, and John B. Gordon. Those of the Northwest Company are John R. Bartlett, Henry C. Andrews, George C. Gorham, Albert P. Fisher and David M. Kelly. Each company is to have a capital of $10,000,000, divided into shares of $50.

FIGURES OF ERIE CO.'S BUSINESS.—The Erie Telegraph and Telephone Company have complete returns from their various divisions for the months of January and February, 1884, which show an increase of 300 subscribers, making a total March 1, 1884, of 8,662. The receipts for the quarter ending Dec. 31, 1883, were $130,457.50, and for the quarter ending March 31, 1884 (March being estimated on a basis of January and February), they will amount to $135,681.46, an increase of over $4,000. The directors of the company have met to consider the matter of declaring the usual quarterly dividend, which is to be one per cent.

THE BUSINESS OF THE TROPICAL COMPANY.—The company has sold its plant at Trinidad for about $20,000, some $15,000 payable in cash and the balance before 1886. The Tropical is to get $5 per set per year for the 150 instruments now there until January, 1887, then gets $20 a set bonus, which will end the royalties on these instruments. The new company agrees to buy all of its supplies from the Tropical, which is to receive royalties on all new instruments up to 1892, when the new company is to buy them for $25 a set. The company has a proposition for the purchase of its only remaining exchange at Barbadoes, a larger one than the Trinidad. It also has an order for another 100 sets from Buenos Ayres. The companies at Rio are moving for a union of interests.

THE BELL COMPANY'S BOOKKEEPING.—This is the latest, probably the last, about the "patent" item in the Bell Company's balance-sheet. The point appears to have been fully cleared up: "The explanation given in the *Sunday Herald* of the puzzle offered by the American Bell Telephone Company in their recent annual statement of making their patents figure as liabilities, seems to resolve itself into this: The company is liable to make $6,591,324.30 profit from their patent account, according to the balances on their books Feb. 29, 1884. In no other sense can this credit balance properly be counted a liability. To call it such when it really is a profit, prospective or ascertained, is an erroneous statement. The same accusation pertains to the other credit balances, 'profit and loss' (which is, or should be, ascertained profits), 'income,' 'reserve' and 'surplus,' aggregating $4,385,337.52, likewise classed as liabilities in the statement. Their 'patent' account should figure among their assets, if, as is presumed, the company continue to hold valuable rights, patents, etc., which possibly could be disposed of for a consideration, and thus made to swell this already large profit account, for the amounts received for their rights and patents over and above the cost of the same is pure and simple profit, and should be separately considered. The mistake the officials make is in naming their statement one of assets and liabilities when it should have been called a balance statement. In the shape they published it, it is misleading to those not conversant with accounts."

THE ELECTRIC LIGHT.

ON THE OREGON SHORT LINE.—The completion of the Hodges Pass tunnel on the Oregon Short Line of the Union Pacific is an important event. The tunnel, with its wooden sheds, is about half a mile in length, and much of the work on it has been done with the help of the electric light.

ON THE ENGLISH STAGE.—The *Pall Mall Gazette* says of the electric light on the English stage: "Never before has such an effect been seen as a stage darkened for a moment only to be instantaneously illuminated with hundreds of ballet girls in armor, and every point in their stage harness picked out with stars of electric light. When the inventor of the new theatrical trick arrived at Charing Cross station with his ballet dresses and machinery, he was promptly arrested by the detectives as a Parisian Fenian, and had to prove his connection with the theatrical trade before they would let him go."

NO NIGHT THERE.—Speaking of the electric lighting in Washington, a description of which appeared in our last issue, a dispatch from that city says: The capacity of each lamp is rated at 4,000 candles. The light from the monument in the immediate neighborhood is inconsiderable, but a mile away it is so great that you have no difficulty in reading the face of a watch. At that, and even a greater distance, shadows are distinctly cast, and the streets are sufficiently lighted. From the Smithsonian tower the grounds are so illuminated that you can read ordinary print. The light radiated from the Capitol dome is so great that the city authorities turned off the gas from 400 or 500 lamps within a certain radius, leaving the streets lighted.

TIFFANY AND CO.'S SUCCESSFUL OBJECTION.—Judge O'Gorman has decided, in Superior Court, Chambers, to continue the injunction restraining the United States Illuminating Company from erecting a pole or poles, and from stringing wires for electric lights in front of the premises of Tiffany & Co., at Union square and Fifteenth street. The Judge said that it was a question of fact whether the poles and wires would be detrimental to the enjoyment by Tiffany & Co. of air and light, and of an unobstructed way to and from their store; that this question must be determined on the trial, but that the preponderance of the evidence before him was that such detriment and obstruction would result, and that, if the question should finally be determined in favor of the plaintiff, the defendant company must be perpetually restrained unless it paid for the privilege of infringing on the easement of the plaintiff in the public streets.

THE HARTFORD ELECTRIC LIGHT CO.—At the annual meeting of the Hartford Electric Light Company, held in that city on the 3d inst., the following gentlemen were chosen directors for the ensuing year: A. C. Dunham, vice-president of the Willimantic Linen Company; Thomas O. Enders, president of the United States Bank; Leverett Brainard, of Case, Lockwood & Brainard; George S. Gilman, of the Connecticut Mutual Life Insurance Company; Charles H. Owen, attorney-at-law; Burdett Loomis, manager of the Citizen's Steam Gas Company, all of Hartford; Henry Stanley, president of the Stanley Rule and Level Company, New Britain, Conn.; H. M. French, vice-president of the same company; and Edward H. Goff, of Boston. At a subsequent meeting of the directors, the following officers were chosen: A. C. Dunham, president; H. M. French, vice-president; Howard M. Clark, teller United States National Bank, secretary and treasurer; and F. A. French, superintendent.

A FULLER PLANT IN BROOKLYN.—The Lamp and Gas Committee of the Brooklyn, N. Y. Board of Aldermen, visited the station of the Kings County Electric Light Co., at 33 South Fifth street, E. D., that city, on March 25. The company proposes to light the Eastern District. The Fuller system is used, and the plant is very highly spoken of. "We have facilities at our plant now for supplying 225 lights," said President Charles Cooper that afternoon, "and nearly all of them have been spoken for by Broadway and Grand street business men. We have dynamos and lamps and the requisite power for supplying the lights within a shorter time than any other company, especially as we have made a contract with the New York and New Jersey Telephone Company for the use of their poles. The plant is not more than half a block from the poles at Dunham place. In a word, should the privilege we apply for be granted by the Common Council we would be able to operate inside of ten days. The people of the Eastern District, we know from the applications being made to us for lights, are very anxious that the electric light should be introduced in our section. Our company was the first to offer the city any concession; the others followed reluctantly in our wake."

MISCELLANEOUS NOTES.

IMITATING NOBILI'S ELECTRO CHEMICAL RINGS.—M. C. Decharme has performed new experiments showing that Nobili's electro-chemical rings may be imitated by means of a continuous stream of water falling from a cylindrical tube vertically on a horizontal piece of black glass moistened all over.

MR. EDISON BUYING MUSIC.—We hear that Mr. Edison has just bought a dozen copies of Mr. J. H. Milliken's "Dot and Dash." We remember that once on a time Mr. Edison called his children "Dot" and "Dash," but though that fact may have influenced him a little in purchasing so largely, the music is fine enough to sell everywhere among those who can appreciate a good thing.

AN AMERICAN ENGINE IN ENGLAND.—The Armington & Sims Engine Company have placed in the British House of Commons a second engine, for the purpose of driving additional electric light machinery. As one of these engines has been in use in the House for some two years, the company feel especially pleased to receive another order. In spite of a strenuous competition from British manufacturers there are already some thirty of these engines running in the city of London.

"A RATHER MYSTERIOUS AFFAIR."—The Dublin *Express* of March 22 publishes the following story: A rather mysterious affair has happened in connection with the insulated electric railway on the Giant's Causeway and Portrush Tramway. It appears that the country people are in the habit of touching the rail and receiving harmless shocks, but on Thursday evening a ploughman returning with his horses stood on the rail to mount. Immediately on his applying his hand to the horse's back the brute fell dead against the rail. The strange part of the affair is that the man is uninjured, although the current passed through his body to the horse.

THE DIFFERENCE OF POTENTIAL NECESSARY FOR SPARKS IN AIR.—According to Prof. Foster and Mr. Pryson, let V = the difference of potential, l = length of spark in centimetres; their experiments gave (approximately), $V = 102\,l + 7.07$. Tables and curves of the sparking distances, potentials, and electric forces in the experiments were given. The results were got with brass balls 1.35 centimetre in diameter, a frictional machine, and a Foster absolute electrometer. When $l = 0.142$ the electric force giving a spark was 154.76; $l = 0.284$ the electric force was 133.35, or less than a at shorter distance; $l = 0.497$ the electric force was 131.66; $l = 0.9$ the electric force was 133.57—that is, it began to rise again.

STOCK QUOTATIONS.

Telegraph, telephone and electric light stocks were quoted as follows on Thursday at the Electric, Manufacturing and Miscellaneous Stock Exchange, and at the Stock Exchange:

TELEGRAPH.—Am. Cable, b 58½, a 59; American Rapid, b 50, a 65; B. & M. Co., b 127 a 127¾; Commercial Telegram Company, a 70; Harlem District Telegraph Co., a 5.50; Bankers & Merchants' Telegraph Co. 1st. mtge bonds, a 85; Manhattan Telegraph, b 10, a 85; Mexican, b 125, a 147; Northern & Southern Tel. Co. 1st mtge bonds, b 79, a 81; Postal Telegraph (stock), b 7.75, a 8; Postal Telegraph bonds, 1st 6 per cent., b 58.00, a 58.50; Postal Telegraph and Cable Co., b 15.50; Western Union, b 68⅜, a 69.

Dr. Norvin Green, speaking of Western Union improvements, says: "We spend about $1,000,000 a year in entirely new construction to meet the increasing demands of business. I think that about $3,300,000 of our surplus is in new lines, and that $500,000 more is in material in store. The cash surplus is small after the payment of the dividend. I shall explain this matter fully in my next annual report for some persons who pretend not to understand it."

TELEPHONE.—American Bell, b 162, a 163; American Speaking, b 110, a 125; Currier Telephone Bell, b 3; Colombia and Panama, b 24.50, a 25; Continental, b 15; Dolbear, b 5, a 10; Erie, b 28, a 35; Globe, b 9.25, a 10.50; Hudson River, b 60, a 90; Inter-Continental, b. 95, a 1.25; Mexican, b 2.50, a 3.25; Mexican Central, a 3; Molecular, b 5.50, a 10; New York, a 85; New York and New Jersey, a 80; New York and Pennsylvania, b

50, a 80; Overland, b 8, a 17; People's, b 9.50, a 10.50; People's (N. E.), b 1.50; Shaw, b 10; Solenoid, a 125; Southern Bell, b 95, a 125; Southern New England, a 175; Tropical, b 2, a 2.50; West India Telegraph and Telephone, b 1.90, a 2.

The Boston *Advertiser* of April 10, thus quotes the local market: In telephone stocks American Bell declined 1¼ to 157; Erie ⅝ to 32¾; New England ⅛ to 28½; Mexican sold at 2 9-16 and Tropical at 2½.

The Cumberland Telephone Company of Tennessee has increased the quarterly dividend to 2 per cent. The company is meeting with great success in Nashville and Memphis.

Erie telephone is steady at 32⅝. The quarterly meeting of the directors was held on the 9th. The auditor's report for the quarter ending Dec. 31, 1883, showed that the company had earned $130,457.50 and disbursed $64,248.86, leaving the net earnings $66,208.64. Deduct the quarterly dividend paid Jan. 25 of 1 per cent., $48,000, and there remains a surplus of $18,208.64, which, added to the previous surplus of $30,239.36, makes a total surplus of $48,488 to Jan. 1, 1884. The increase of subscribers for October, November and December was 812; for January and February, 300: total number connected March 1, 1884, 8,728. The gross earnings for the quarter ending March 31, estimating March, show an increase of $4,000 per month. At the present rate of increase the officers of the company state that by Aug. 1 the company will be able to carry on its entire construction, paying operating expenses and a dividend at the rate of 4 per cent. per annum on the issued stock, 48,000 shares. A dividend of 1 per cent. was declared, payable April 25, 1884, to stockholders on record April 15. The books will be closed from April 16 to the 25th, inclusive.

ELECTRIC LIGHT.—Edison, a 140; Excelsior, a 25; United States Co., a 95.

The Brush Electric Light Company, of New England, has declared a dividend of five per cent.

BUSINESS NOTICES.

THE FISKE-MOTT INSULATOR.—Mr. N. D. Fitch, President of the Chicago Insulating Company, has been making a trip through the Eastern and seaboard States in the interests of his company, and reports that he has met with excellent success with the Fiske-Mott insulator.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

Edited by N. S. KEITH, Electrical Engineer and Expert, 237 Broadway, New York.

PATENTS DATED MARCH 25TH, 1884.

Armature-Coil for Dynamo-Electric Machine; James J. McTighe, of Pittsburg, Pa..... 295,789

A prepared armature-coil having a wedge-shape in cross-section, its layers of wire interlocked by tying and covered externally with an insulating band or tape wound spirally thereon.

Battery Electrode or Element; Eli T. Starr, of Philadelphia, Pa., Assignor of one-half to H. M. Lewis and James W. White, both of same place, and William J. Peyton, of Washington, D. C..... 295,889

Consists of an open sided frame having set therein layers or folds of woven or interlaced wire in the form of a flat plaited or braided strip or strips, the frame surrounding the edges of the plate formed by said folds or layers and being firmly united thereto.

Coupling for Electric Wires; George L. Kitson, of Philadelphia, Assignor to William J. Philips, of same place..... 295,559

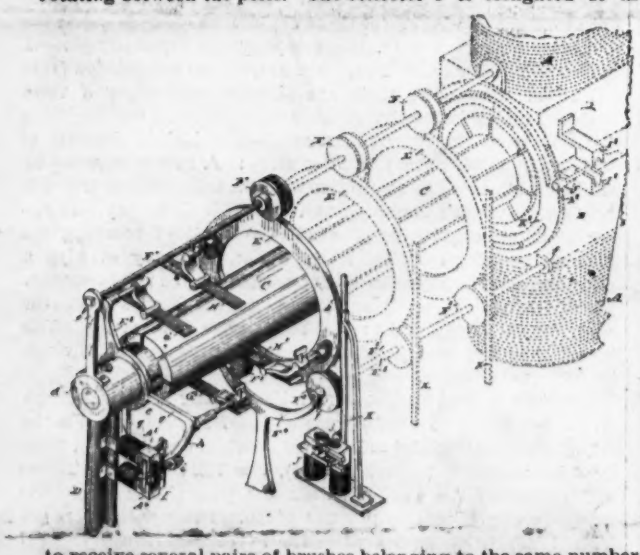
The two ends of the wires to be joined are beveled to match; a groove is cut across the faces of each to receive a key which is driven to place after the ends have been encased in a short metal tube. The parts having previously been faced with tin or solder are heated after keying to melt the solder, and so permanently fix the junction.

Driving Gear for Dynamo-Electric Machines; John W. Boothby, of New York, N. Y..... 295,614

Means for running a dynamo on a railway car always in one direction, whichever way the car may be moved, and also for keeping the belt from car-axle to dynamo always tight against the up-and-down movement of the body of the car.

Apparatus for Regulating and Distributing Currents from Dynamo-Electric Machines; William Hochhausen, of New York, N. Y..... 295,552

A and *B* are the field-magnets and poles of the known Hochhausen dynamo, with the usual Gramme form of armature rotating between the poles. The collector *C* is elongated so as



to receive several pairs of brushes belonging to the same number of circuits. These brushes are carried by rings *E*, *E*, *E*, which are supported by the grooved rollers *F F²*, so that they may be revolved separately around the collector. These rings are automatically moved by electro-motors as at *I* or *J*. These motors are moved to or fro by currents derived from the circuits to which the brushes they move belong, by means of automatic circuit changers which admit currents in one or the other or both directions to effect movement in one or the other direction or stoppage. Arrangements are provided for keeping the electro-motive force of the machine constant; but the difference of potential between the brushes of each pair is varied by moving them to or fro by means of the electro-motor when the necessities of the circuit to which they belong require such change.

Electric Alarm for Spring Clocks; Edward Jungerman, Gettysburg, Pa..... 295,873

Consists in indicating the unwound or spent condition of a spring clock, by closing an electrical circuit by the expansion of the main-spring and producing an audible or visible signal.

Electric Fire-Alarm; John Hill, of Columbus, Georgia..... 295,759

An electric-circuit is closed at the place of the fire by the fusion of a fusible plug in obvious manner. This insures the ringing of an alarm at a distant station and the movement of a dial pointer to a place on the dial which indicates the locality of the fire.

Electric Hot Air Furnace Regulator; Frank Miller Sparrow, of Mattapoisett, Mass., Assignor by mesne assignments to himself and William E. Sparrow, of same place..... 295,686

A metallic thermostat makes suitable circuits which energize an electro-magnet to open or close dampers of a furnace when too cold or too warm.

Electric Implement; Arthur H. Kinder, of Boston, Mass., Assignor to Amasa S. Barnes, of same place... 295,652

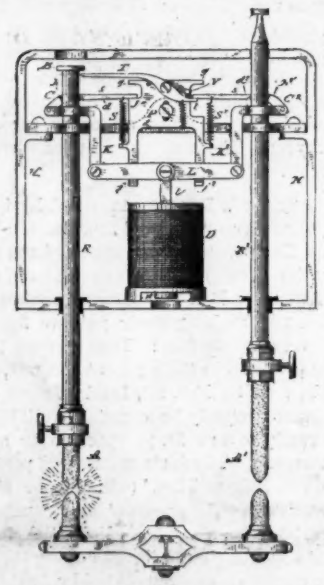
A motor of the old Siemens H armature type is mounted on one end of the handle. A reciprocating movement is given to a tool at the other end of the handle through the medium of an eccentric and strap on the shaft of the motor and a rod running through the handle and carrying the tool. A chuck is also affixed to one end of the shaft, for holding drills, etc.

Electric Lamp; Wensel Moravа, of Chicago, Illinois. 295,664

A core of a solenoid in the main circuit raises a train-bearing lever and the positive carbon rod to form the arc. A dog acting as a detent at the same time falls into engagement with the train of wheels to stop the feed. When the difference of potential between the two carbons has increased from combustion, a magnet in a circuit around the arc becomes sufficiently energized to bring its armature into a contact which makes a circuit through another electromaguet, which, in its turn, then pulls the dog from engagement so that the feed may take place.

Double Carbon Arc Lamp; Elihu Thomson, of New Britain, Conn., Assignor to the Thomson-Houston Electric Co., of Connecticut..... 295,836

Consists in the combination, with the releasing or feed-con-



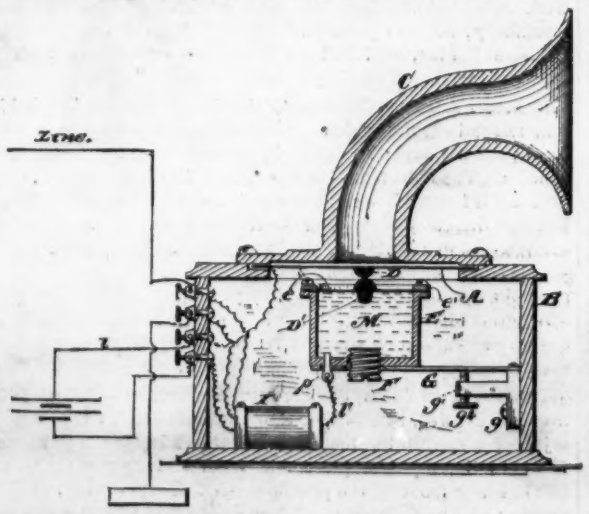
trolling clamp for one or the carbons, of a releasing table or stop for said clamp, made movable and normally held out of the position where the clamp will be released, but set into position for releasing the clamp by the action of the other carbon-carrier when its carbon is nearly consumed. The solenoid *D* actuates both clamps *C* and *C²* at proper times through the arm *L* and links *K* and *K²*. *J* acts as a rest or trip for the clamp *C* through its arm 5. The end *t* of the lever *T* performs a similar office for the clamp *C²*; but when the cap *B* is above *T* the end *t* is too low to allow the tripping of *C²*, and therefore its carbon-carrier is held in position firmly. But when *R* has descended, from burning of its carbon, so that *B* rests on *T*, it thus elevates the end *t* so that it trips the clamp *C²*, and thus allows *R²* to slip downward until the carbon *A²* comes into contact with its mate, when the arc is formed there—the light shifting from *A* to *A²*.

Galvanic Battery; Conrad Pabst, of Stettin, Germany..... 295,671

Carbon and metal electrodes in an electrolyte, consisting of an aqueous solution of a chlorine salt, which is capable of assuming the conditions of subchloride and perchloride, and still remain in solution. For instance: carbon and iron in a solution of perchloride of iron. As the iron enters the solution from action of the battery it becomes oxidized by contact with the atmosphere and is deposited at the bottom of the cell as sesquioxide of iron. Thus the battery liquid is continually regenerated by natural causes.

Telephonic Transmitter; Charles A. Randall..... 295,807

C is the tube which is spoken into. *D* is a carbon electrode fas-



tened in electric contact with the diaphragm. *D¹* is a carbon electrode fastened to a flexible cover *e* of the vessel *E*, which contains a liquid, mercury, for instance, which fills the vessel and presses against the cover *e* and its electrode. The pressure is regulated by the screw *F*; and the vessel is raised or lowered by means of the set-screw *g²* working against the lever *C*. *I* is the usual induction coil.

Magneto and Dynamo-Electric Machine; Friedrich Gustav Frick, of Bayenthal, near Cologne, Germany..... 295,534

This machine was patented in Germany in 1877. It is of the class called "disk-armature," or radial-wire machines. The armature sections are connected in closed-circuit, with loops to the sections of a collector, as in the Gramme machine.

Printing Telegraph; Albert F. Johnson, of Brooklyn, N. Y..... 295,644

Consists, first, in improved means for connecting the several letter-keys on the keyboard at the sending station and the several printing-maguets on the receiving instrument with one common line-wire, instead of employing a separate line-wire for each letter; and, secondly, in improved means for equalizing the movements of the mechanisms at the sending and receiving stations, so that they shall act in perfect unison.

Sealed Galvanic Battery Cell; William T. McGinnis, of New York, N. Y., Assignor to James H. Shaw, of same place..... 295,574

A carbon-cup is inclosed in a bottle during the process of manufacture of the bottle, and a platinum wire connected with the carbon-cup is also sealed through the glass at the same time. The zinc electrode is attached to the cork or stopper, through which a wire connected with the zinc is passed.

Sidewalk-curb and Surface-case for Electric Wires; Richard Wylie, of Napa, Cal..... 295,710

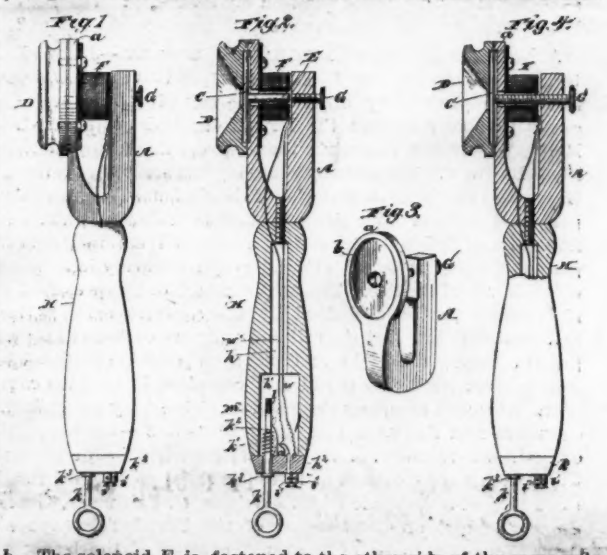
Consists in a case for electric wires, formed of grooved castings or blocks arranged along the curb and across the streets at the crossings. They are provided with covers which can be easily removed and replaced.

Telegraphic System; Charles G. Burke, of Richmond Hill, N. Y..... 295,855

Consists in dividing the letters of the alphabet into separate and independent groups, preferably seven in number, designating each of the several groups by a particular electric current or combination of currents, and in indicating the individual letters contained in any particular group by the interval of time elapsing after the group is designated before a succeeding group is designated, which interval agrees in units to the position of the letter in the first group.

Telephonic Receiver; C. A. Randall, of New York, N. Y..... 295,804

A permanent magnet is formed as shown in fig. 3. The diaphragm *C* is placed with the ear-piece *D* over the circular recess



b. The solenoid *F* is fastened to the other side of the same pole of the magnet, and a core *E*, fig. 2, is fastened to the diaphragm, and a regulating screw *G* is provided to determine the attractive distance between the two poles. Or, the regulating screw passes through the solenoid almost in contact with the diaphragm as in Fig. 4. The suitable connections are made within the handle of the instrument by movement of the rod *K* due to the spiral spring *K¹* when the instrument is removed from the hook which passes through the ring of *K* when hung up.

Telephone Support; George W. Fish, of Pecatonica, Ill..... 295,531

Consists of a bracket carrying at its outer end a vertical rack, upon which slides a clip for the receiver. The clip has a catch, which engages with the teeth of the rack to sustain the receiver at the proper height for the ear of the listener.

Telephone Transmitter; Daniel Drawbaugh, of Eberly's Mills, Penn., Assignor to The People's Telephone Co. of New York, N. Y..... 295,741

Two diaphragms placed with their faces parallel, each carrying one of the two carbon electrodes which touch each other on inclined faces, so that by movement of the diaphragms a slight slipping or scraping varying contact is made. One or both of the electrodes consists of an envelope of carbon containing finely-divided conducting material, such as powdered carbon. A third electrode enters this powdered material.

Telephone Transmitter; Daniel Drawbaugh, of Eberly's Mills, Pa., Assignor to the People's Telephone Co., of New York, N. Y..... 295,742

Electrodes consisting of flat plates having their surfaces in contact, the said surfaces being covered with a hard, thin coating of finely divided conducting material combined with an agglutinating substance.

Telephonic Transmitter; Charles A. Randall, of New York, N. Y..... 295,805

Consists in improvements in that class of transmitters in which levers are attached to the diaphragm for amplifying the vibrations. A carbon or slate diaphragm is used.

Telephonic Transmitter; Charles A. Randall, of New York..... 295,806

An amplifying-lever transmitter in which the contacts are made through loosely-fitting carbon blocks on the nearly vertical long ends of the lever.